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TRANSLATOR'S AFFIDAVIT

I, Andrew Wilford, a citizen of the United States of America, residing in Dobbs Ferry, New York, depose and state that:

I am familiar with the English and German languages;

I have read a copy of the German-language document attached hereto, namely PCT application PCT/DE2003/002197 published 26 February 2004 as WO 2004/016379; and

The hereto-attached English-language text is an accurate translation of the above-identified German-language document.

Andrew Wilford

Sworn to and subscribed before me
6 January 2005

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Specification

Cutting Tool for Material-Removing Machining

The invention relates to a cutting tool for material-removing machining, provided with a tool holder rotatable about an axis and having at least one seat for a cartridge that serves as a tool holder for a cutting insert and with an adjustment device having an eccentric pin for radially shifting the cartridge.

A milling tool described in EP 0,739,258 has a milling head on whose end face are mounted several cutting inserts each held in a respective cartridge. Each of the cartridges is received in a respective groove in the milling head. The cartridges each have a radial bore in which is provided an eccentric that can be rotated to set the axial position of the cartridge. Once the axial position is set, the cartridge is locked onto the tool head by mounting screws.

Grooves in the periphery of a milling head according to EP 0,697,933 hold respective cartridge each holding a cutting insert and a spacer plate. The engaging faces of each cartridge and the respective spacer plate are formed with teeth. In addition a pin engages radially in an opening in the floor of each groove and has a head that is eccentric to the smooth cylindrical shaft of the pin. The eccentric head engages in a recess or throughgoing groove on the back face of the respective cartridge and is formed with a recessed seat so that this pin can be turned. Rotation of

the eccentric shifts the respective cartridge axially. A threaded hole in the cartridge receives a screw serving for radial adjustment of the cutting inert or of the cartridge.

It is an object of the present invention to provide for a cutting tool of the above-described type an adjustment mechanism that is different from the prior art and that is easy to use, simple to build, and still capable of extremely fine adjustment of the radial position of the cartridge of the cutting insert fixed to it. Preferably this adjustment mechanism should also be very compact.

This object is achieved by the cutting tool according to claim 1.

According to the invention a cartridge groove holds an adjustment wedge that is axially shiftable by means of an eccentric pin. As a result of the longitudinal/axial movement of the adjustment wedge in the cartridge, the cartridge is shifted in or out by a travel that is a function of the wedge apex angle, in such a manner that the radial position of the cutting insert can be exactly set even when it is necessary to compensate for tolerance deviations in the dimensionally varying cutting inserts. The eccentric serves for radial shifting of the cartridge in both directions, that is radially inward and radially outward, without further equipment.

Preferably the eccentric pin is set in a radial bore of the cartridge, so that a hex key or similar tool can be inserted from outside through an access bore into a seat of the eccentric to actuate it. To this end the eccentric has an eccentric cylindrical extension that engages in a slot of the adjustment wedge, so that rotation of the eccentric shifts the adjustment wedge and thus the cutting edge of the cutting insert radially exactly.

According to a further embodiment the cartridge is retained in the tool holder by a wing wedge that can be locked in place by a screw, preferably a double-thread screw, in the tool holder, the wing wedge bearing when tightened against a cartridge face. This wing wedge serves to lock in the set radial position of the cartridge and those of the cutting insert being used, that is for carrying out a material-removing machining operation.

In order to retain the eccentric pin from dropping out of the cartridge, the eccentric pin is held by a retaining sleeve against radial movement.

The apex angle of the adjustment wedge between 8° and 12°, preferably 10°.

Further embodiments of the cutting tool according to the invention as well as its advantages are given in the following with reference to the drawings. Therein:

FIG. 1 is a partial section in exploded view through a drill rod with an assembled cartridge;

FIG. 2 is a perspective exploded view of the cartridge with the adjustment wedge;

FIG. 3 is a perspective exploded view in of the drill rod with the wing wedge;

FIG. 4 shows the drill rod with the wing wedge installed (without cartridge); and

FIGS. 5, 6, and 7 are various perspective sectional views through the cartridge.

The present invention, which is described with reference to a drill rod 10 that is rotatable about an axis 11, is mountable in any tool holder rotatable about an axis. The drill rod 10 serving as tool holder here has a seat with side support faces 12a, 12b, and 12c and a floor surface 12d. This seat can receive a cartridge 13 held in place by a wing wedge 33 bearing on its front face. The cartridge 13 has a seat holding a cutting insert 14 that has in this case a corner cutting-edge insert 15 of polycrystalline diamond. This cutting insert is secured by a retaining screw 16 in the cartridge.

As shown in detail in FIGS. 1, 2, and 5 to 7, a longitudinally extending groove 17 receives an adjustment wedge 18 that can shift in the groove 17 through a travel a. This longitudinal and axial shifting slides the curved inner surface 19 of the cartridge 13 relative to the outer wall surface 20 of the adjustment wedge 18 such that the longitudinal movement of the adjustment wedge 18 relative to the cartridge 13 changes their relative radial positions. FIGS. 6 and 7 show end positions of the cartridge while FIGS. 5 and 6 show the radial outermost position of the cartridge and FIG. 7 the radial innermost position. To axially

shift the adjustment wedge there is an eccentric pin 21 set in a radial bore in the cartridge. This eccentric pin has an eccentric cylindrical extension 22 that engages in a slot 23 in the adjustment wedge. Rotation of the eccentric pin 21 shifts the axial position of the cylindrical extension 22 so that the adjustment wedge is shifted axially in the cartridge. The adjustment wedge 18 bears with a flat 22 on the floor face 12d while the cartridge 13 is movable radially through a travel that is a function of the axial travel a and a wedge angle α. FIGS. 5 and 6 show different views illustrating the maximum cartridge radial movement for axial shifting through the travel a. If the travel a is equal to 0 (see FIG. 7) the cartridge 13 is raised minimally.

A retaining sleeve 24 prevents radial dropping-out, being driven into place after assembly of the cartridge with the adjustment wedge and the eccentric pin.

A hex wrench 26 is inserted into a hex recess of the eccentric 21 to actuate it.

To assemble the cartridge shown in FIG. 1, first the eccentric body 21 is inserted into the existing bore 27 to engage an end face 28 thereof. Then the adjustment wedge is slid into its groove in the cartridge until the slot 23 of the adjustment wedge is aligned with the cylindrical extension 22 whereupon the eccentric pin and its extension are pushed downward as shown in FIGS. 5 and 7. The retaining sleeve 25 is then fitted in place so as to lock the cartridge, the adjustment part, and the eccentric relative to each other. The cartridge can now be fitted into the seat of the drill rod and secured in place by the wing wedge 33,

which wing wedge 33 can be actuated by the double-threaded screw 30 to clamp the cartridge via its front face 31. Radial adjustment of the cartridge with the cutting insert 14 and its cutting edge is possible when the clamping pressure exerted by the wing wedge 33 is only slight. When the hex tool 26 is fitted into the hole 22 and set in the seat of the eccentric pin 21, this eccentric pin can be rotated so as to axially shift the cylinder pin 22 of the adjustment wedge 18 axially between an axial position with a = 0 (FIG. 7) to the position of FIGS. 5 and 6 with a = 2 to 3 mm. The mutually engaging slide surfaces 19 and 20 permit radial movement so that a radial fine adjustment of the cutting edge of the cutting insert is possible. After the optimal radial position of the cartridge has been established, actuation of the double-threaded screw 30 pulls in the wing wedge 33 and clamps the cartridge 13 in place.

It is particularly advantageous with the system of this invention that the radial position of the cartridge can easily be adjusted by radially inserting the hex wrench or another screwdriver 26.